

Memorandum

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To : Commissioner David Rohy
Commissioner Michal Moore

From : California Energy Commission - Lorraine White
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Subject : Supplemental Water Resources Testimony to the Pittsburg District Energy Facility (98-AFC-1) Staff Assessment

In its May 7, 1999 Notice of Evidentiary Hearings, the California Energy Commission's Siting Committee for the Pittsburg District Energy Facility (PDEF), directed parties to file additional written testimony on Air Quality, Public Health, and cumulative impacts on Water Resources.

On May 14, 1999, staff filed its supplemental testimony for Air Quality. Enclosed is the supplemental testimony for Water Resources.

Enclosure
cc: Proof of Service

SOIL & WATER RESOURCES

Supplemental Testimony of Joseph O'Hagan and Nancy Monsen

INTRODUCTION

The purpose of this supplemental testimony is to discuss the potential that the proposed Pittsburg District Energy Facility (PDEF) will contribute to a significant cumulative impact on water quality. This testimony will specifically address the potential of the combined Delta Diablo Wastewater Treatment Facility (DDWTF) and the Delta Energy Center (DEC) discharges to adversely affect the City of Antioch's water supply.

As discussed in staff's previously filed testimony; PDEF will utilize approximately 3.4 million gallons per day (mgd) of tertiary treated effluent from the DDWTF. PDEF will return approximately 0.97 mgd of wastewater to the DDWTF. In addition, DEC is proposing to use 5.3 mgd of tertiary treated effluent from the DDWTF. For wastewater discharge, DEC will use either the DDWTF outfall or an existing Dow Chemical outfall. Approximately 2.1 mgd of wastewater from DEC will either be returned to the DDWTF outfall or to the Dow Chemical outfall. See Soil & Water Resources Figure 1 for project and outfall locations.

As also indicated in previous staff testimony, neither PDEF nor DEC will cause an increase in the total mass pollutant discharge to New York Slough, compared to the existing DDWTF discharge. There will be an increase in the concentration of the discharge. These increased concentration levels, however, will still be within the existing National Pollutant Elimination System (NPDES) Permit limitations for the DDWTF.

Therefore, for cumulative impacts the concern is that the increased concentration of the discharge from the DDWTF outfall will not be sufficiently dispersed prior to reaching the City of Antioch water intake.

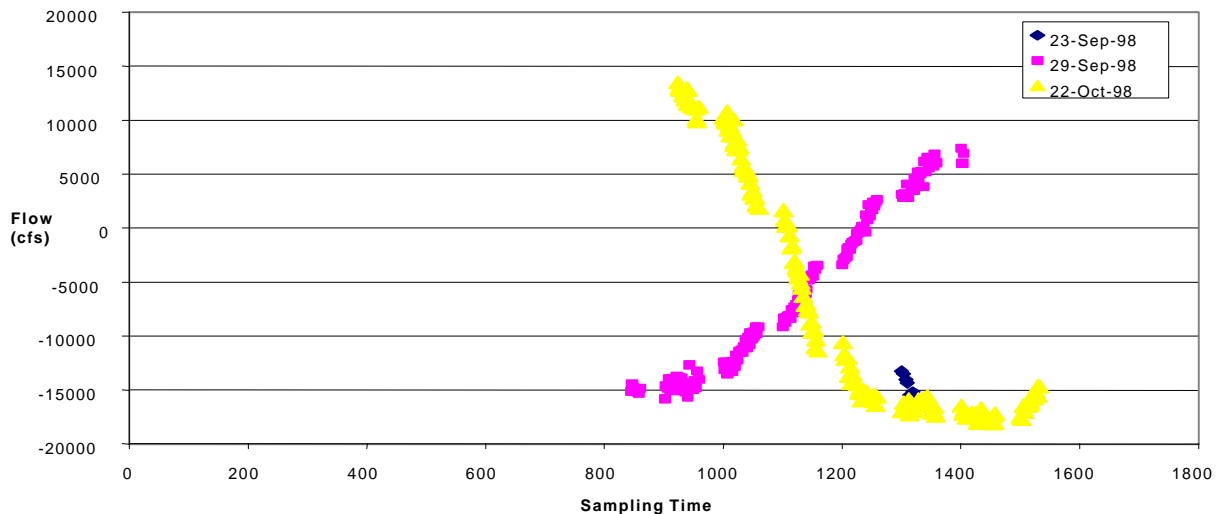
As shown in Soil & Water Resources Figure 1, the DDWTF and Dow Chemical outfalls or diffusers are located in New York Slough, a channel connecting the San Joaquin River with Suisun Bay. The DDWTF outfall extends approximately 710 feet into the channel and terminates at a depth of about 22 feet below mean sea level (DEC 1999). The Dow Chemical outfall extends approximately 360 feet into the channel and terminates at a depth of 36 feet below mean sea level (DEC1999).

The location of the water intake for the City of Antioch, approximately two miles upstream of the DDWTF outfall, is also shown in Soil & Water Resources Figure 1. The City takes up to 16 mgd of water from this uptake, representing approximately 60 percent of the city's water supply. Therefore, protection of this water source for the city is of critical importance.

As noted above, New York Slough connects the San Joaquin River with the Suisun Bay and is estimated to carry 40 to 60 percent of the river's flow. As is characteristic of estuarine environments, however, flow in the slough can be

reversed due to tidal action. To illustrate the flow reversals that characterize Suisun Bay, Soil & Water Figure 2 shows United States Geologic Survey (USGS) flow data collected on three separate days in the fall of 1998. The sampling location is north of the existing DDSD outfall and situated between Winter Island and Brown Island and represents the deepest water in the immediate vicinity of the proposed projects.

Soil & Water Resources: Figure 2



Flow Data from the San Joaquin River at Winter Island

CUMULATIVE IMPACTS

The initial dilution rate of the wastewater discharge is due to the velocity of the discharge (jet velocity) and buoyancy. As the wastewater flow (jet) exits the diffuser and enters the receiving water, a shear layer is formed between the jet and the water. Waves within the shear zone entrain ambient water into the jet and mix the two fluids, diluting the concentration of the discharge. With distance, the jet flow widens and velocity and concentration declines. Buoyancy relates to the relative density between the discharge and the receiving water. Differences in density may be due to different temperature, salinity concentrations or both. If the discharge density is less than that of the receiving water, the discharge will rise through the water column increasing mixing due to turbulent flow

The City of Antioch's (1999) specific concerns about the potential for impacts to its San Joaquin River water supply are:

- The reduction in the discharge flow due to the two power plant projects will reduce the velocity of the discharge (jet velocity) exiting the DDWTF diffuser, lessening the amount of dilution.

- The increased concentration of the discharge due to the two power plant projects will lessen the buoyancy of the wastewater stream, resulting in lessened initial dilution.
- During periods of decreased San Joaquin River outflows and upstream tidal excursions, water in New York Slough will be saltier and denser so the density between the discharge and the receiving water would be less, further reducing dilution. Subsequent mixing that occurs due to vertical, lateral and longitudinal dispersion occurs at a substantially lower rate than the initial dilution leading to potential impacts on the city's water supply.

As part of the NPDES permit application for DEC, dilution and dispersion modeling was conducted to estimate the behavior of the wastewater discharge plume. The dilution and dispersion modeling for the DEC application is subdivided into three separate modeling efforts. Staff has conducted an initial evaluation of this modeling. A complete evaluation of the modeling and the underlying assumptions will be undertaken as part of the DEC AFC process.

Initial dilution of the discharge from the outfall due to jet mixing and buoyancy was modeled using the United States Environmental Protection Agency (EPA) model UDKHDEN. Factors taken into account include effluent flow variation and density, ambient water density and currents and diffuser orientation and port configuration. A number of model runs were conducted for a range of discharge flows, current speeds and ambient densities (DEC 1999). Important factors in identifying a worse case for initial dilution include shallow water conditions due to low tide conditions, stratification within the water column due to high water densities and low current velocities. Stratification was found in the modeling runs to be the most critical condition.

Staff's evaluation of DEC's initial dilution modeling using UDKHDEN was very extensive and explored a wide range of critical scenarios. The critical range of currents, densities, and stratification scenarios were reasonable and addressed those raised by the City of Antioch. Dilution for their studies ranged from 48:1 to 281:1 for the DEC outfall. For the DDSO outfall, dilution factors ranged from 34.4:1 to 656:1. For comparison, the range for the current Delta Diablo Sanitation District configuration for these scenarios was 39:1 to 181:1.

The subsequent transition-mixing region used the modified Brooks Method. Within the transition-mixing region, the discharge plume is still somewhat coherent and mixing is not as rapid as that of the initial phase. This modeling indicated that the plume from the DDSO discharge hit the southern shoreline of New York Slough approximately 2500 to 5000 feet downstream of the discharge under average conditions. The assumptions made for this part of the study has not been fully evaluated by staff at the present time.

Because the estuary system that the DEC facility would be releasing to is very complex, the DSM2 which is used by the California Department of Water Resources was used to define the hydrodynamics of the region. In addition, the subprogram,

QUAL was used to estimate the background dilution in the immediate area of the discharge. Because the DSM2 model is a one-dimensional representation of flow, the model consists of a series of channels and nodes representing junctions. At each junction all the water entering from the main channel and any tributary water during a timestep is mixed completely. The DEC facility is located very close to (3700 feet downstream) the confluence of New York Slough and Broad Slough. During flood tide, water flows from New York Slough into Broad Slough. With the model representation, any concentration in New York Slough (~940 feet wide) is mixed with the Broad Slough (~3000 feet wide) when the node is reached. This effectively mixes the concentration across the entire span of Broad Slough and increases the dilution. In reality, the flow in this region is very two dimensional in nature. It would not be expected that the concentration would be immediately mixed across the channel. Modeling results indicate that approximately 25,000 feet downstream, dilution reaches 96:1, assuming an initial effective dilution of 48:1. Factoring in vertical mixing, this number reaches 263:1. Therefore, results of this model may not be adequate to predict exact concentration levels at the City of Antioch intake. This needs to be investigated further during the DEC AFC process.

CONCLUSIONS

The DEC (1999) modeling done for the initial dilution using UDKHDEN is extensive and well thought out. The results of this modeling indicate that the discharge plume will be diluted at a minimum of 48:1, which is slightly higher than that estimated for the DDSO discharge, 39:1. Staff's evaluation of the initial modeling effort is that it accurately characterizes the likely dilution of the discharge. Therefore, although providing effluent for the two power plant projects will lead to higher discharge concentration, initial dilution of the discharge plume will be quite similar to that of the existing discharge. Although the extent of transition and far field dilution is still to be evaluated, it is clear that given the level of estimated initial dilution and the potential level of additional dilution in the transition and far field zone, discharge concentrations will reach background levels prior to reaching the City of Antioch water supply.